REMARKS

The applicants appreciate the Examiner's thorough examination of the application and request reexamination and reconsideration of the application in view of the following remarks.

The applicants acknowledge and appreciate the Examiner's allowance of claims 93 and 94.

The Examiner objects to claims 60-63 because of the dependency of claim 60. Claim 60 has been amended.

The Examiner rejects claims 1, 64-66, 70-72, 78, 80-83 and 92 under 35 USC §102(b) as being anticipated by U.S. Patent No. 6,108,594 to *Didinsky et al.*

The applicants' claim 1 recites, *inter alia*, a controller system which synchronously integrates an output of the star camera system and an output of the gyroscope system into a stream of data. The flight computer is responsive to the stream of data and determines the attitude of the aerospace vehicle from these outputs.

In conventional systems, a problem arises because the star camera system and the gyroscope system typically are each developed and manufactured by different companies with each system having different hardware and software. Thus, application-specific software must be created to resolve the two separate attitude inputs -- a cumbersome, high power and computationally intensive and expensive process that is prone to error. See e.g. the applicants' specification at page 4, line 12 through page 13, line 13. The applicants' claimed invention solves the traditional problem of having each of the star tracking system and gyroscope system output their attitudes separately without combining them into a data stream for a data processing unit or flight computer (not to be confused with the host spacecraft computer) to determine the spacecraft attitude.

As noted by the applicants when comparing the present invention to conventional systems:

> In contrast to conventional attitude sensors, controller system 16 synchronously integrates gyroscope system output G and star camera system output A into stream of data C …
>
> The fusion of gyroscope system and star camera system data in this invention provides a significant improvement in the performance of both devices, resulting in a more robust aerospace vehicle attitude determination system than could be achieved by integrating separate star tracker and gyroscope units in the traditional manner.

See e.g. the applicants' specification at page 23, lines 3-5; page 29, lines 19-22; and see also e.g. the applicants' Fig. 2.

In contrast to the applicants' claimed invention, *Didinsky et al.* fails to disclose that the outputs of the inertial sensors and star trackers are integrated into a stream of data which then proceeds to a flight computer. In *Didinsky et al.*, the output of the inertial sensors and the output of the star trackers remain separate and thus are not integrated into a stream of data. This is clearly shown by Fig. 3 of *Didinsky et al.* for example, which is reproduced at right.

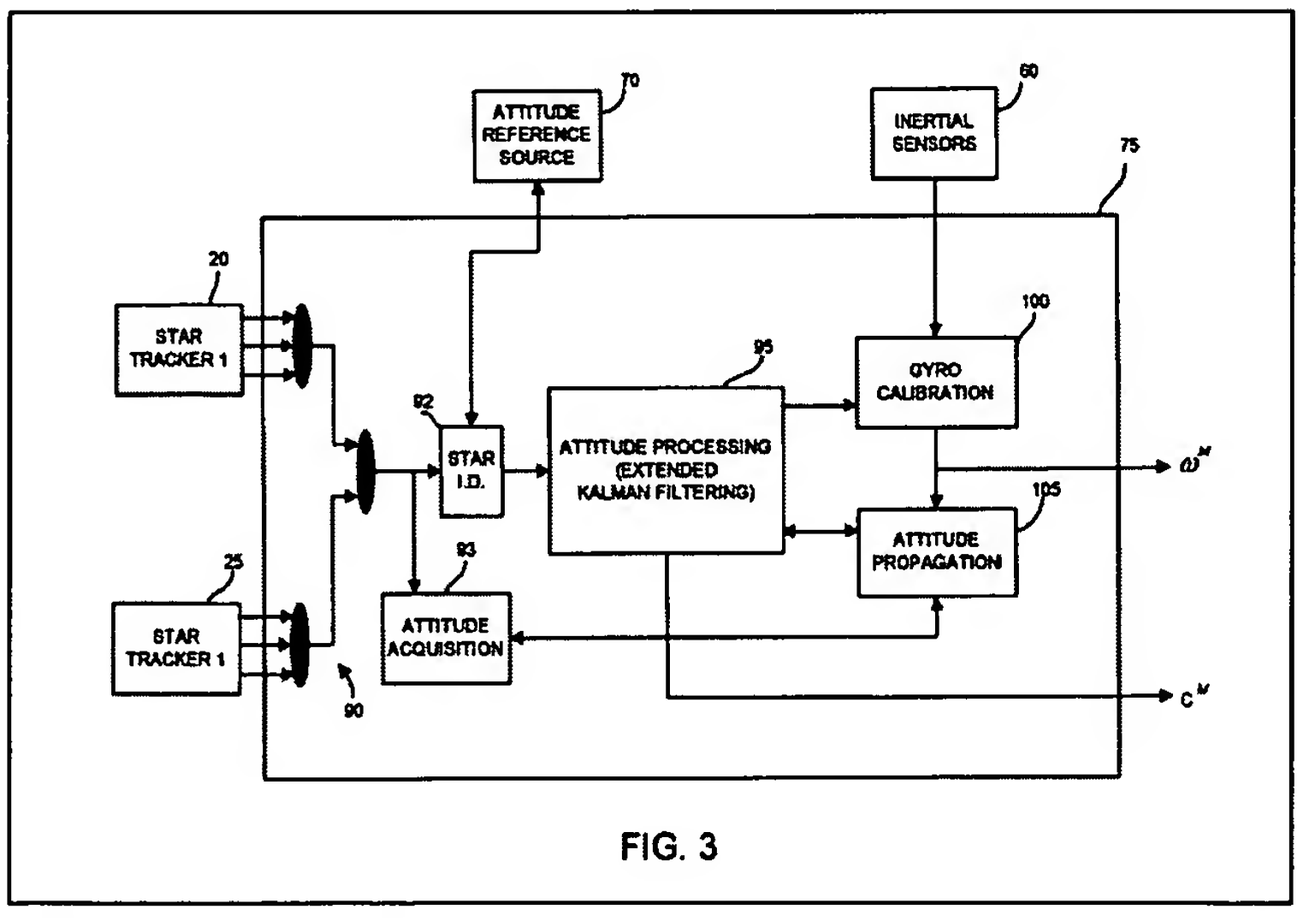

FIG. 3

Moreover, *Didinsky et al.* does not even discuss the problems involved in resolving these two separate attitude inputs. Therefore, *Didinsky et al.* does not offer any solution to these problems and the consequent introduction of error and complexity into its satellite attitude determination. Instead, *Didinsky*'s main concern and goal is to allow attitude acquisition using

(star) pattern matching when the number of available stars is small by steering the satellite to different positions to observe new stars when sufficient stars are not available in the first view. See e.g. *Didinsky et al.* Abstract and column 5, lines 28-44.

Accordingly, *Didinsky et al.* does not anticipate the applicants' claim 1, and claim 1 is in condition for allowance. The applicants' claims 64 and 65 depend from claim 1 and thus are also in condition for allowance. The applicants' independent claims 66, 70-72, 78, and 80-83 each recite some form of a controller system for synchronously integrating star camera system and gyroscope system outputs into a stream of data. The method of independent claim 92 recites the step of selectively, synchronously integrating in a predetermined pattern the star camera attitude and the gyroscope attitude into a stream of data. Accordingly, claims 70-72, 78, 80-83 and 92 are also in condition for allowance for at least the reasons above.

The Examiner also rejects claims 2 and 84 under 35 U.S.C. §103(a) as being unpatentable over *Didinsky et al.* in view of U.S. Pat. No. 5,745,869 to *van Bezooijen*.

Claims 2 depends from claim 1, and claim 84 depends from 83, each of which is in condition for allowance as discussed above. Accordingly, claims 2 and 84 are also in condition for allowance for the same reasons. Further, one of ordinary skill would not be motivated to combine *Didinsky et al.* and *van Bezooijen* because *Didinsky et al.* specifically teaches that "[t]he star trackers 20, 25 may be embodied in digital cameras based on charge-coupled devices (CCDs)", as opposed to an APS star camera.

The Examiner further rejects claim 3 under 35 U.S.C. §103(a) as being unpatentable over *Didinsky et al.* and *van Bezooijen* further in view of U.S. Pat. No. 6,098,929 to *Falbel*, and

claims 4 and 85 over *Didinsky et al.* and *van Bezooijen* further in view of U.S. Pat. No. 6,577,929 to *Johnson et al.* Claims 3 and 4 ultimately depend from claim 1, and claim 85 ultimately depends from claim 83. Accordingly, claims 3-4 and 83 are in condition for allowance for at least the reasons discussed above with respect to claims 1 and 83, as well as the reasons discussed with respect to claims 2 and 84.

The Examiner also rejects claim 5 under 35 U.S.C. §103(a) as being unpatentable over [*Didinsky et al.* in view of *van Bezooijen* in view of] *Johnson et al.* in view of U.S. Pat. No. 5,396, 495 to *Carlson*. The Examiner further rejects claims 6 and 7 under 35 U.S.C. §103(a) as being unpatentable over [*Didinsky et al.* in view of *van Bezooijen* in view of] Johnson et al. and further in view of U.S. Pat. No. 5,963,166 to *Kamel*.

Claims 5, 6 and 7 ultimately depend from claim 1. Accordingly, claims 5-7 are in condition for allowance for at least the reasons discussed above with respect to claim 1, as well as the reasons discussed with respect to claims 2. Moreover, the applicant notes that the necessity to combine many diverse references to reject the applicants' claims itself is an indication of novelty and non-obviousness.

The Examiner also rejects claims 8-21 and 86-87 under 35 U.S.C. 103(a) as being unpatentable over [*Didinsky et al.* in view of] *Kamel* and further in view of U.S. Pat. No. 6,285,928 to *Tilley et al.*

First, claims 8-21 ultimately depend from claim 1, and claims 86-87 ultimately depend from claim 83. Accordingly, claims 8-21 and claims 86-87 are in condition for allowance for at least the reasons discussed above with respect to claims 1 and 83.

Moreover, with respect to claim 16 the Examiner states in pertinent part that "[i]n order for *Didinsky et al.* to be able to integrate the gyroscope data and the star camera data, the outputs at first must be isolated from each other and then integrated so that the data can be unaffected by the data of the other". The Examiner also states that in regard to claim 17, "without a programmable logic device, it would be impossible to integrate the data of the two".

Claim 16 does not recite that each system is isolated so that their data from each is unaffected by the other (although this is true generally). Instead, claim 16 covers the data output from the star camera system and the gyroscope system, and recites a command circuit for selectively synchronously integrating the outputs of the gyroscope system and the star camera system in a predetermined pattern to isolate their outputs during their integration.

As discussed above, *Didinsky et al.* does not teach a command circuit which integrates the outputs into a stream of data at all, much less integration of the outputs in a predetermined pattern to isolate the outputs from each other during integration. See also, for example, the applicants' specification at page 37, line 21 through page 38, line 12 and Figs. 11 and 12 where the camera system data and the gyroscope system data is integrated into stream of data C but is isolated -- i.e. camera data bits and gyroscope data bits may be interleaved for example -- during integrating to allow information to be processed more reliably and efficiently.

This is not at all what is taught by *Didinsky et al. Didinsky et al.* never integrates the star camera system output and the gyroscope system output into a single data stream, and also never isolates the two data outputs during their integrating.

In the applicants' claim 17, a programmable logic device implements the aforesaid selective synchronous integration of the camera system and gyroscope system outputs in a predetermined pattern. In contrast, *Didinsky et al.* does not integrate the outputs into a data

stream; does not isolate these outputs during integrating; and does not do so in a predetermined pattern.

Accordingly, claims 16 and 17 are in condition for allowance for these additional reasons as well.

Claim 87 recites the method of claim 86 including selectively synchronously integrating the outputs of the gyroscope system and the star camera system in a predetermined pattern to isolate from each other each of the star camera system and gyroscope system outputs during their integrating. Thus, by reasoning similar to that discussed above with regard to claims 16 and 17, claim 87 is also in condition for allowance for this additional reason.

The Examiner also rejects claims 22-43 and 88-89 under 35 U.S.C. §103(a) as being unpatentable over [*Didinsky et al.* in view of] *Tilley et al.* and further in view of U.S. Pat. No. 6,252,578 to *Hsieh et al.*

Claims 22-43 depend ultimately from claim 1, and claims 88-89 ultimately depend from claim 83 and thus are allowable for at least the reasons discussed above with respect to independent claims 1 and 83.

Additionally, with regard to dependent claim 22, for example, the Examiner states in pertinent part that "*Hsieh et al.* discloses a system which needs to be inputted into a stream of data and to do this a data packer is used".

First, *Hsieh et al.* does not teach of star camera system data and gyroscope system data as claimed by the applicants. Second, *Hsieh et al.* does not teach interleaving of the star camera system data and gyroscope system data. Third, as noted above with respect to claims 1, 16, and 17 for example, the cited references including *Didinsky et al.* do not disclose, teach or suggest

any of the applicants' claimed elements which precede using a data packer, namely, integration of the star camera system and gyroscope system data outputs into a stream of data, etc. See the discussions above. In other words, before a data packer is utilized at all, data from the gyroscope system and camera system is synchronously integrated, and interleaved using a data stream packer. It is only the applicants that teach those elements and features.

Accordingly, claim 22 is in condition for allowance for these additional reasons.

The Examiner also rejects claims 44-49 and 51-52 under 35 U.S.C. 103(a) as being unpatentable over [*Didinsky et al.* in view of] *Hsieh et al.* and further in view of U.S. Pat. No. 6,454,217 to *Rodden et al.*

Claims 44-49 and 51-52 depend ultimately from claim 1 and thus are allowable for at least the reasons discussed above with respect to independent claim 1.

The Examiner further rejects claims 67-69 under 35 U.S.C. 103(a) as being unpatentable over *Didinsky et al.* in view of *van Bezooijen* and further in view of *Johnson et al.*

Each of claims 67-69 include, *inter alia*, a controller system for synchronously integrating some form of camera and gyroscope outputs into a stream of data. In this regard the Examiner states that column 3, lines 54-58 of *Didinsky et al.* discloses a controller system for synchronously integrating an output of the star camera system and an output of the gyroscope system into a stream of data. As discussed above in detail however, *Didinsky et al.* does not disclose the claimed integrating at all. This is especially clear from *Didinsky et al.* at column 3, lines 54-58 which simply states:

Information from the inertial sensors is used in conjunction with the star trackers 20, 25 to acquire the attitude of the satellite in conjunction with the present invention.

The use of star trackers and gyroscopes to obtain attitude in the conventional manner, as taught by *Didinsky et al.*, was known, but it included many problems such having each of the star tracking system and gyroscope system output its attitude separately. Such problems are <u>not</u> discussed or solved by *Didinsky et al.* but <u>are</u> solved by the applicants' claimed invention, as discussed in more detail above.

With respect to claims 67-69 the Examiner also states that it would have been obvious to use both the APS star camera system (disclosed in *van Bezooijen*) and the MEMs gyroscope system (disclosed in *Johnson et al.*) "because both are well known in the art and are commonly used".

Missing from the Examiner's analysis is the fact that *van Bezooijen* does not suggest a MEMs system, and *Johnson et al.* does not suggest an APS camera, and the fact that consequently neither of these cited references provides disclosure that would enable them to be used together, in contrast to the applicants' claimed invention.

Accordingly, for the above reasons, claims 67-69 are in condition for allowance.

The Examiner also rejects claims 73-77 under 35 U.S.C. 103(a) as being unpatentable over *Didinsky et al.* in view of U.S. Pat. No. 6,463,365 to *Anagnost et al.*

First, the applicant points out that claim 73 depends from claim 72, and claims 72, 76 and 77 each include a controller system for synchronously integrating star camera and gyroscope system outputs into a stream of data. Thus, claims 73, 76 and 77 are allowable for this reason, as discussed above.

Additionally, the Examiner points to Fig. 2 of *Anagnost et al.* in support of the rejections. However, Fig. 2 of *Anagnost et al.* is simply a block diagram of the components in the payload 14 (see *Anagnost et al.* column 3, lines 33-34 and column 4, lines 24-25). Fig. 1 of *Anagnost et al.* -- which is indeed a diagram of the satellite -- shows that all components are enclosed within one housing, and *Anagnost et al.* does not disclose any additional views regarding additional housings for the components enclosed therein. This is in contrast to the applicants' claims 73, 76 and 77.

Accordingly, claims 73, 76 and 77 are in condition for allowance for each of these reasons.

The Examiner further rejects claim 79 as being unpatentable over *Didinsky et al.* in view of *Hsieh et al.*

Claim 79 recites, *inter alia*, a controller system for synchronously integrating an output of said star camera system and an output of said gyroscope system into a stream of data, the controller system including a data stream packer for interleaving said output of the star camera system and said output of the gyroscope system into the stream of data.

A controller for synchronous integrating is discussed above, as is the data stream packer for interleaving the star camera system and gyroscope system data into a stream of data.

Accordingly, for at least the same reasons, claim 79 is also in condition for allowance.

Finally, the applicants acknowledge and appreciate the Examiner's indication that claims 50, 53-63 and 91 would be allowable if written in independent form including all of the

limitations of the base claim and any intervening claims. The applicants' new claims 96-108 are presented in response.

CONCLUSION

Each of the Examiner's rejections has been addressed or traversed. Accordingly, it is respectfully submitted that the claims 1-108 are in condition for allowance. Early and favorable action is respectfully requested.

If for any reason this Response is found to be incomplete, or if at any time it appears that a telephone conference with counsel would help advance prosecution, please telephone the undersigned or his associates, collect in Waltham, Massachusetts, (781) 890-5678.

Respectfully submitted,

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